Phase Transitions in the Systems of Identical Rigid Molecules in Perfect Alignment-Relations of the Smectic A and Columnar Orderings in Liquid Crystals and the Crystalline Ordering to the Molecular Shape

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The method of symmetry breaking potential is applied to the system of identical rigid molecules with simple typical shapes (rod with square cross-section, square plate and cube), which are perfectly aligned, to examine the occurrences of such various types of spatial ordering as in smectic, columnar and crystalline phases in relation to the molecular shape. A smectic A phase occurs in the system of rigid rod molecules much more easily than the close packed crystal structure does in the system of rigid sphere molecules. Columnar and crystalline phases do also similarly in the system of molecules of square plate and cube, respectively. It is also shown that the nematic-smectic A transition in the case of rigid rod molecules in perfect alignment is the second order one, in contrast with those in the others of typical first order transitions. The effect of orientational fluctuation is discussed in short.

コロイド系における合金構造

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1. 緒　　言

コロイド粒子は熱運動を行うという点で，原子と同等である。故にサイズのそろった（単分散の）粒子からなるコロイドは，原子系とその統計的性質を同じくする，すなわち，原子系を数千倍に拡大した系とみなしうる。そして粒径が3000Å以上の粒子は顕微鏡で見えるので，これは「眼に見える原子」であり，統計力学的モデルとしては，現在のところ，最上のものであろう。しかしながら，ペラン以後は，これを応用した例は極く少ない。

その理由は，単分散コロイドの「ある程度の量」を「ある程度の濃度」で，しかも「安定」に調製することが至難であったことによる。ペランが，沈降平衡の実験のために，極く少量の